

CLEAN SET

4. The powder of claim 39 comprising a mean porosity of 0.5 – 80%.
5. The powder of claim 4 wherein the microstructures comprise a porosity of 2-40%.
6. The powder of claim 5 further comprising a mean pore size of 20 – 200 nm.
7. The powder of claim 6 further comprising a mean pore size of 50 – 100 nm.
8. The powder of claim 39 further comprising a fine particle fraction of greater than 20% w/w.
9. The powder of claim 8 further comprising a fine particle fraction within 30-70% w/w.
10. The powder of claim 39 wherein the bulk density is less than 0.1 g/cm³.
11. The powder of claim 39 wherein the bulk density is less than 0.05 g/cm³.
12. The powder of claim 39 wherein said particulate microstructures comprises hollow porous microspheres.
13. The microspheres of claim 12 further comprising a shell thickness between 0.1–0.5 μm.
14. The powder of claim 39 wherein the mean aerodynamic diameter of said particulate microstructures is between 0.5 μm and 5 μm.
15. The powder of claim 14 wherein said particulate microstructures have a mean geometric diameter of less than about 5 μm.

18. The powder of claim 39 wherein said phospholipid is selected from the group consisting of dilauroylphosphatidylcholine, dioleoylphosphatidylcholine, dipalmitoylphosphatidylcholine, disteoylphosphatidylcholine, dibehenoylphosphatidylcholine, diarachidoylephosphatidylcholine and combinations thereof.

19. The powder of claim 18 wherein said phospholipid comprises a gel to liquid crystal transition temperature of greater than 40° C.

20. The powder of claim 39 wherein said active agent is a bioactive agent.

21. The powder of claim 20 wherein said bioactive agent is selected from the group consisting of antiallergics, bronchodilators, pulmonary lung surfactants, analgesics, antibiotics, antiinfectives, leukotriene inhibitors or antagonists, antihistamines, antiinflammatories, antineoplastics, anticholinergics, anesthetics, anti-tuberculars, antivirals, immunoactive agents, vaccines, immunosuppressive agents, imaging agents, cardiovascular agents, enzymes, steroids, DNA, RNA, viral vectors, antisense agents, proteins, peptides and combinations thereof.

22. The powder of claim 20 wherein the bioactive agent is selected from the group consisting of nicotine, fentanyl, morphine, lung surfactant, PTH, leuprolide, interferon, insulin, budesonide formoterol, goserelin, and growth hormones.

23. A powder composition of claim 39 wherein said particulate microstructure comprises a perforated microstructure.

39. A powder composition comprising a plurality of particulate microstructures, said microstructures comprising a structural matrix comprising an active agent, calcium and a phospholipid, wherein said microstructures comprise a geometric diameter of 1-30

microns, an aerodynamic diameter of less than 5 microns, and a bulk density of less than about 0.5 g/cm³.

40. A powder composition comprising a plurality of particulate microstructures, said microstructures comprising a structural matrix comprising calcium and a phospholipid wherein said phospholipid comprises a gel to liquid crystal transition temperature of greater than 40° C.

41. The powder of claim 40 wherein said microstructures comprise a geometric diameter of 1-30 microns, an aerodynamic diameter of less than 5 microns, and a bulk density of less than about 0.5 g/cm³.

42. The powder of claim 41 wherein the geometric diameter is less than 10 microns.

43. The powder of claim 42 further comprising an active agent.

44. The powder of claim 42 wherein the geometric diameter is less than 5 microns.

45. The powder of claim 43 or claim 44 wherein the bulk density is less than 0.1 g/cm³.

46. The powder of claim 45 wherein the bulk density is less than 0.05 g/cm³.

47. The powder of claim 40 wherein said phospholipid is selected from the group consisting of dilauroylphosphatidylcholine, dioleoylphosphatidylcholine, dipalmitoylphosphatidylcholine, disteoylphosphatidylcholine, dibehenoylphosphatidylcholine, diarachidoylephosphatidylcholine and combinations thereof.

49. The powder of claim 43 wherein said active agent is a bioactive agent selected from the group consisting of antiallergics, bronchodilators, pulmonary lung surfactants,

analgesics, antibiotics, antiinfectives, leukotriene inhibitors or antagonists, antihistamines, antiinflammatories, antineoplastics, anticholinergics, anesthetics, anti-tuberculars, antivirals, immunoactive agents, vaccines, immunosuppressive agents, imaging agents, cardiovascular agents, enzymes, steroids, DNA, RNA, viral vectors, antisense agents, proteins, peptides and combinations thereof.

50. The powder of claim 49 wherein the bioactive agent is selected from the group consisting of nicotine, fentanyl, morphine, lung surfactant, parathyroid hormone, leuprolide, interferon, insulin, budesonide formoterol, goserelin, and growth hormones.

51. The powder of claim 49 wherein the bioactive agent is an aminoglycoside antibiotic.